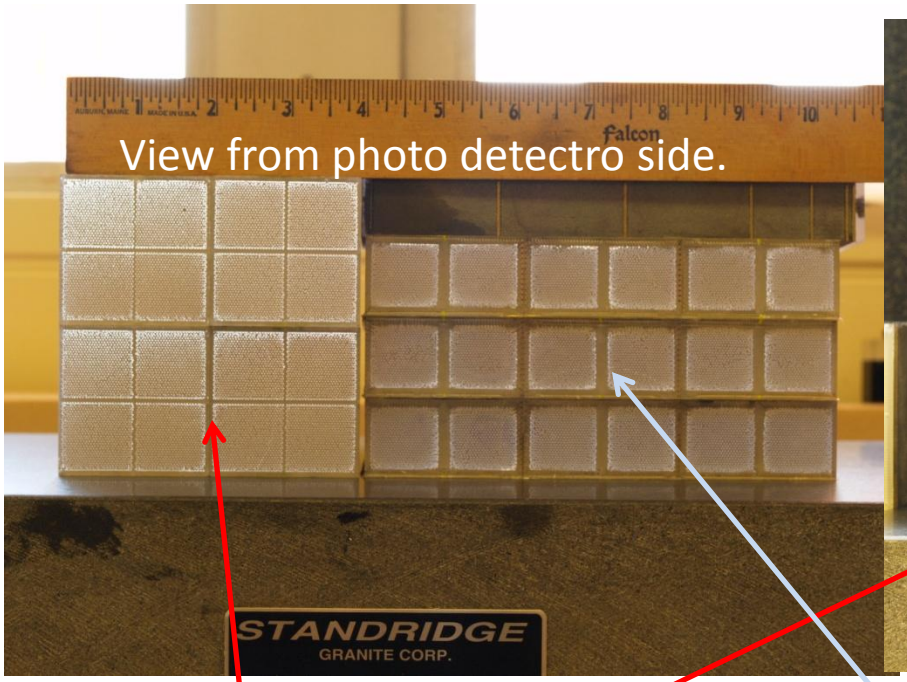
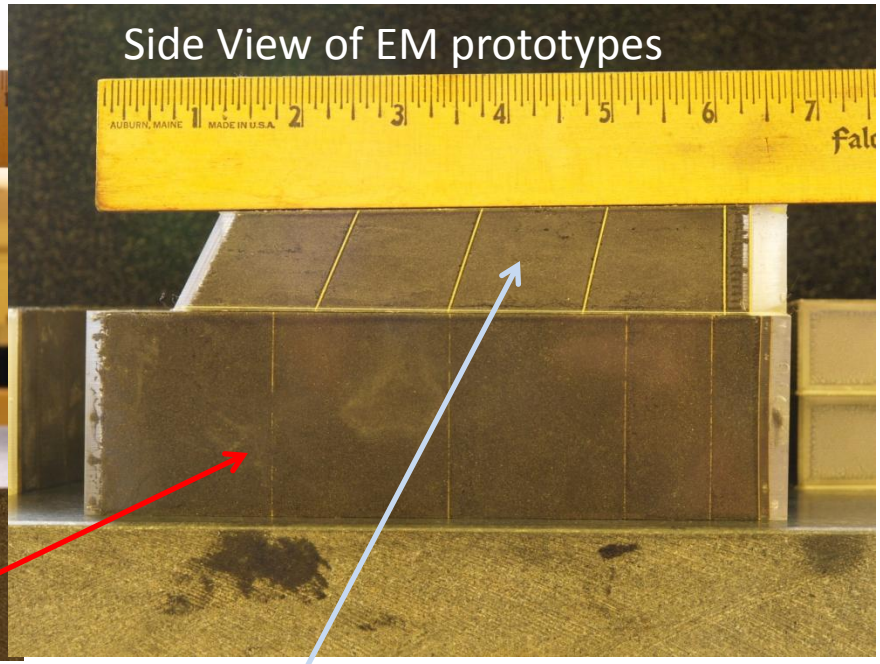
RD1 Update.

1. Status of prototypes for the test run at FNAL
2. T dependence of MPPC response
3. Result of tests with IUCF front end board.
4. Schedule for next few months.

O.Tsai (UCLA), EIC Calor. Meeting , BNL Nov. 7, 2013

EM Prototypes:





EM Prototype for STAR Forward,
~23 X0, matrix of 16 towers.
Goal was to build superblock at once (think about mass production).

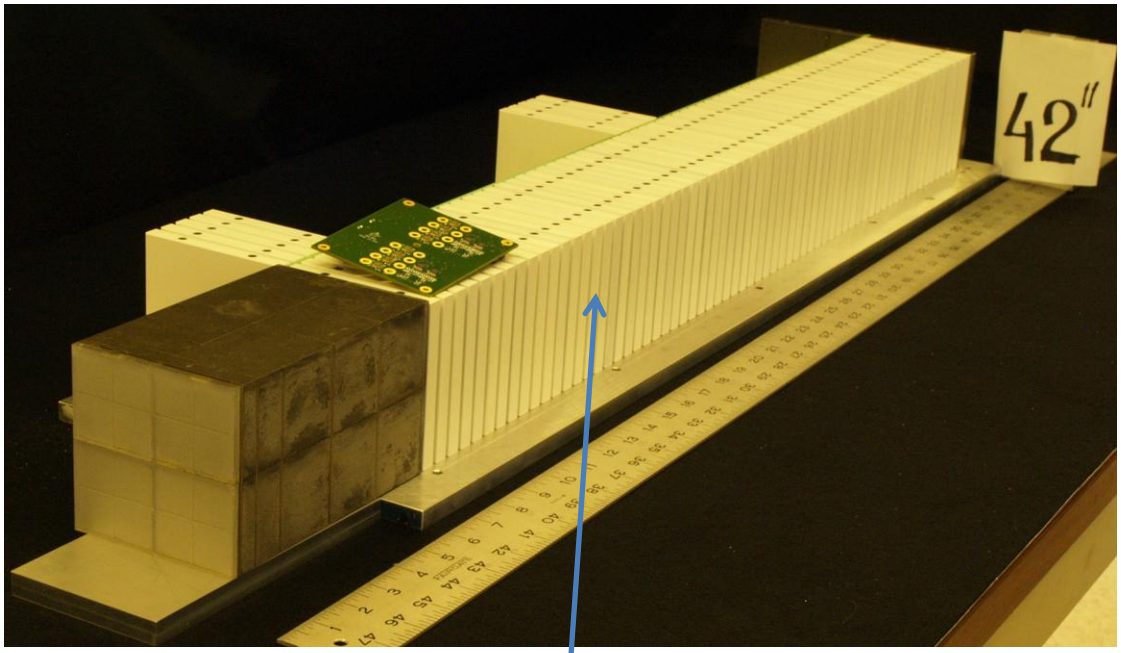
EM Prototype for EIC, non-projective barrel.
~18X0 at eta=0, matrix of 18 towers.
Two types of meshes to get required wedge.
Goal was to check if the idea to build wedge shaped towers will work – it worked quite well (“efficiency” of construction was 100%)

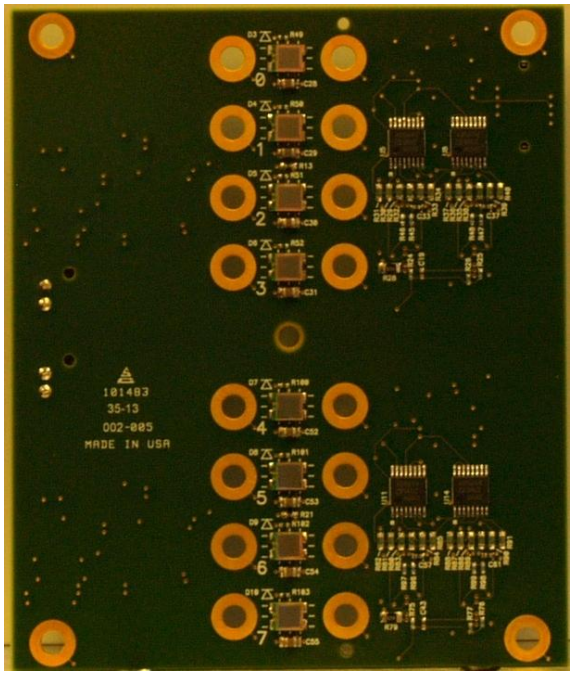
EM prototypes, what is left beside FEEs:

- Finish light guides, glue them. Decide what to do with mirrors (may be different types for EM forward and EM barrel).
- Design, produced all external mechanics for test run (shells).
- Assemble monitoring system (all components in hand, all off shell parts in production at this moment).

No critical items.

- HAD prototype.





HAD Matrix is 4X4 towers, each 10x10 cm2, ~80 cm long (4 int. length)

Design is same as for ZEUS Pb/Sc prototype (10 mm Pb/ 2.5 mm Sc) WLS bar for light collection.

IUCF, FEE board.

8 SiPM/tower

HAD prototype, what is left (beyond FEEs):

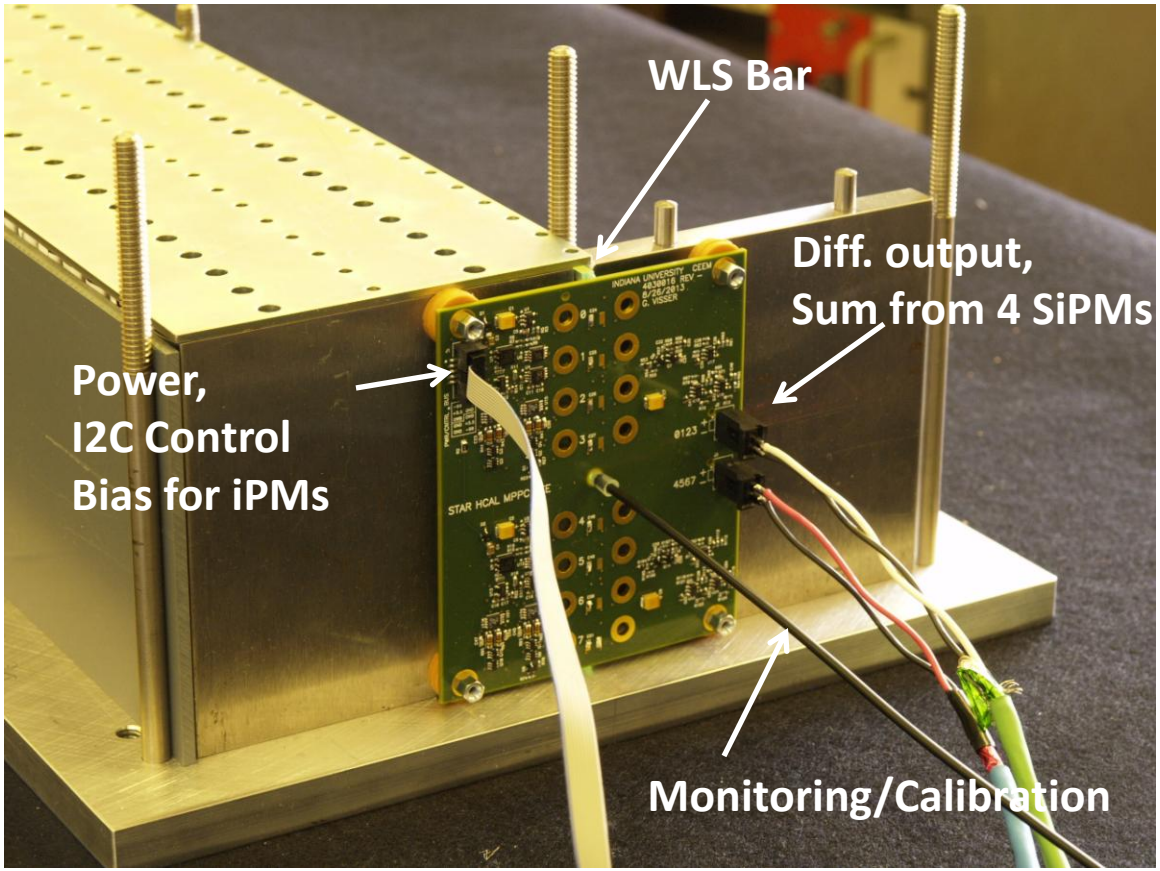
Almost all mechanical components are ready for shipment to FNAL, except of ~50% of Sc tiles which need to be cut in size/polished (edges).

Need to design external shell (non structural, only for light leak protection).

Need to “measure” dopant concentration in all 16 WLS bars.

No critical items.

- HAD FEE, first prototype board from IUCF.



FEE, functionality (quick overview);

1. provide independent, adjustable bias for every SiPM.
2. Provide T compensation of bias (same for all sensors)
3. Amplify/Sum signals from 4 SiPM.
4. Differential driver for cables up to 100 m. long.

First experience working with this board:

a) I2C control software written by Xiaohua Liu (UCLA, postdoc sub contracted), allows full flexibility. In most simple form reads parameters from configuration file and write them to FEE (C++/Linux linkUSB).

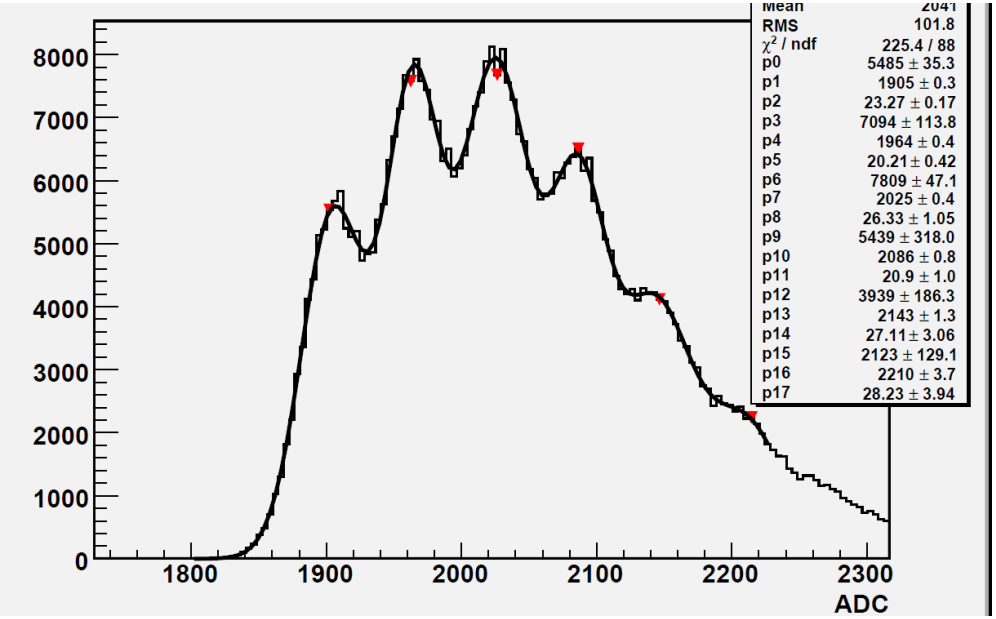
b) All DAC channels need to be calibrated to set bias correctly (not difficult, but required good multichannel calibrated voltmeter and temporarily to solder external cable to the FEE board, may be we should have pins on the back side of the board for that in future).

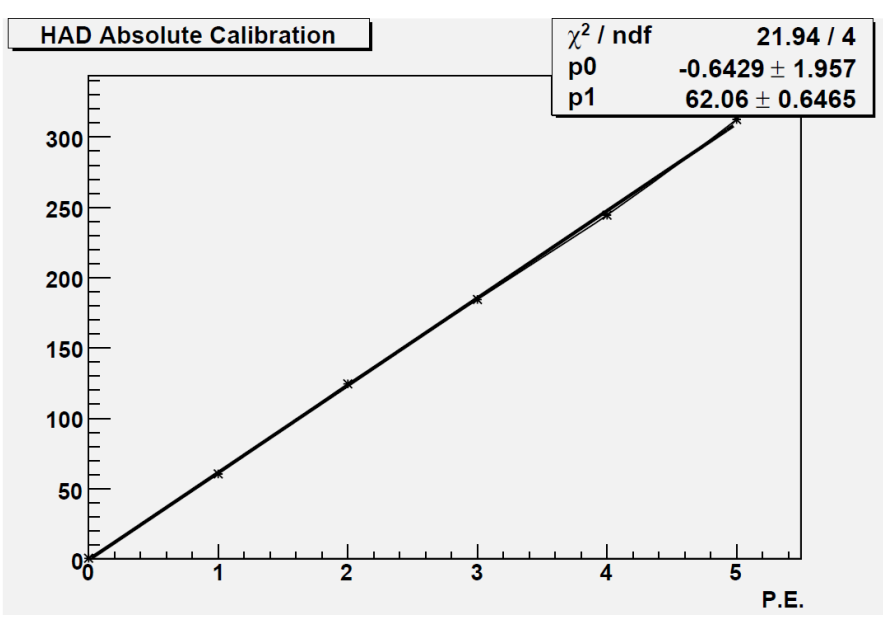
c) Measurements in the T controlled cambers shows that stability of response is about 1% in the T range 18-28 Deg.C (1% is stability of laser measured recently, but not tracked during measurements with FEE board).

T compensation slope was set according to HPK. With different T com. Setting observed few % variation in response vs T.

d) First attempt to measure ENF so far failed due to non-linearity issues (see below).

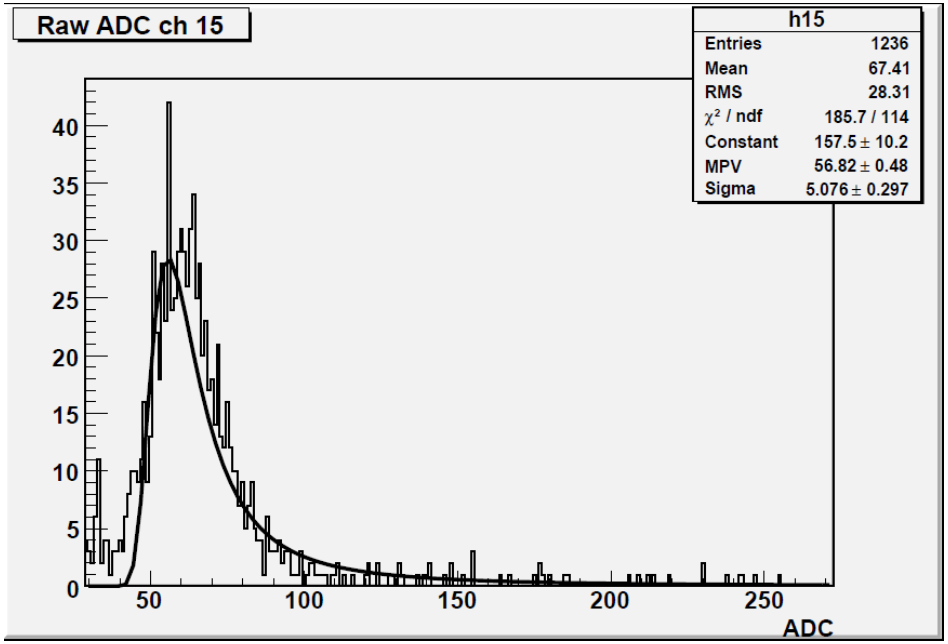
FEE board how it worked so far:

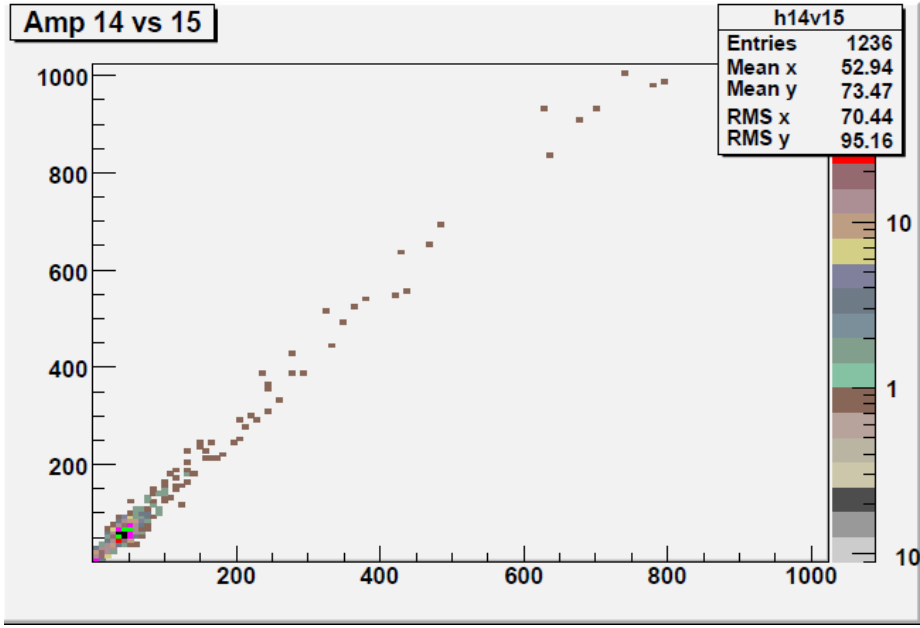




Gain calibration for HAD can be tracked with 1% as seen above.
Note: receiver board is at this moment quick hack to get optical test moving, hope that final version will be better.
Also, there were no external shielding around HAD tower
during cosmic muons tests, potentially noise pickup should be smaller.

Muons in HAD tower





~110 pe/ muon

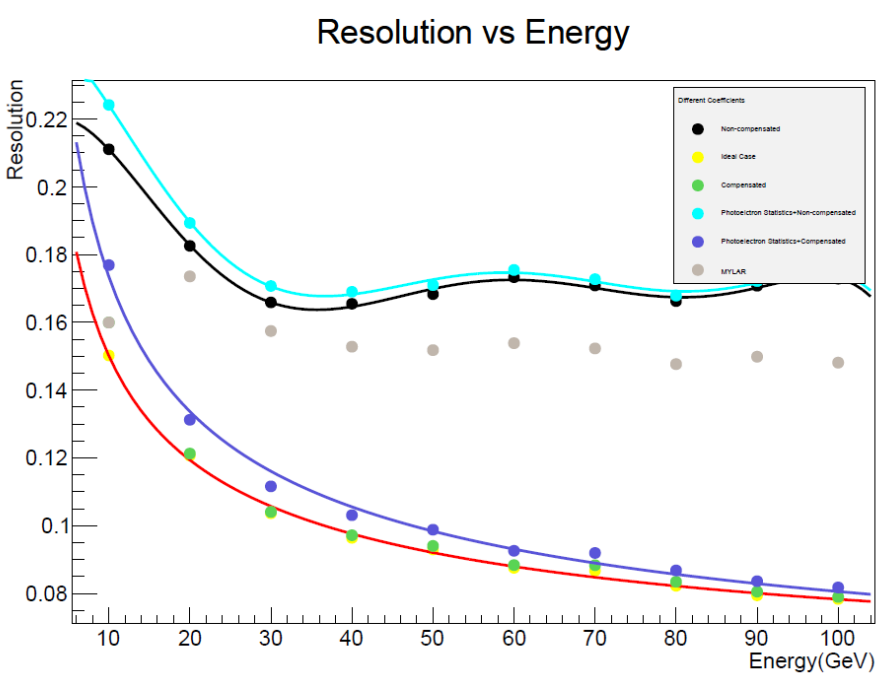
Correlation between two groups of SiPMs,

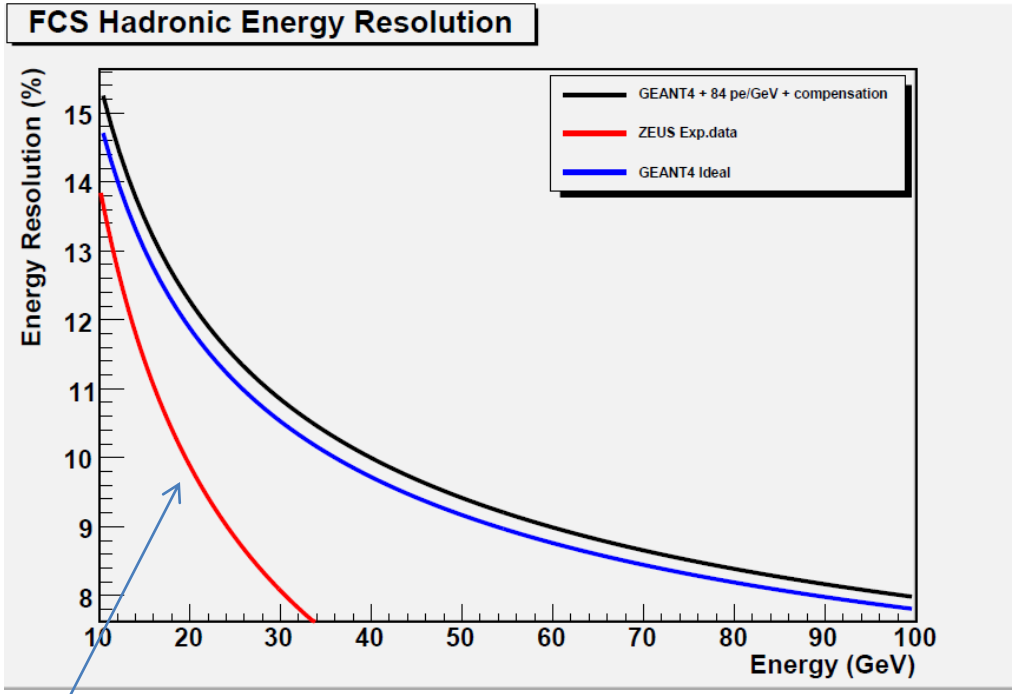
- Receiver channels had slightly different gains

(WLS is ideal mixer, want to explore this next year for EM)

Given e/muon = 0.7 and e/h =1 – Expect to see ~80 p.e. /GeV

FCS Energy resolution according to GEANT4 with SIPM readout and optical Readout scheme (all effect was measured by undergrad student).





ZEUS experimental results! What will we see at the test run is a ?

- **Critical Items (Technical):**

FEE development on critical pass:

1. Need quickly decide on the gain on HAD/EM board (my view need to reduce it x10, decision pended on test with second board at IUCF).
2. Non-linearity observed during optical test, can be due receiver board or Front End – that has to be settled with the second board at IUCF with charge injection.

- FEE development (Schedule Risk is very high):

1) Dec 2. first EM board should be at UCLA to star optical tests.

2) Given that full integration test at UCLA

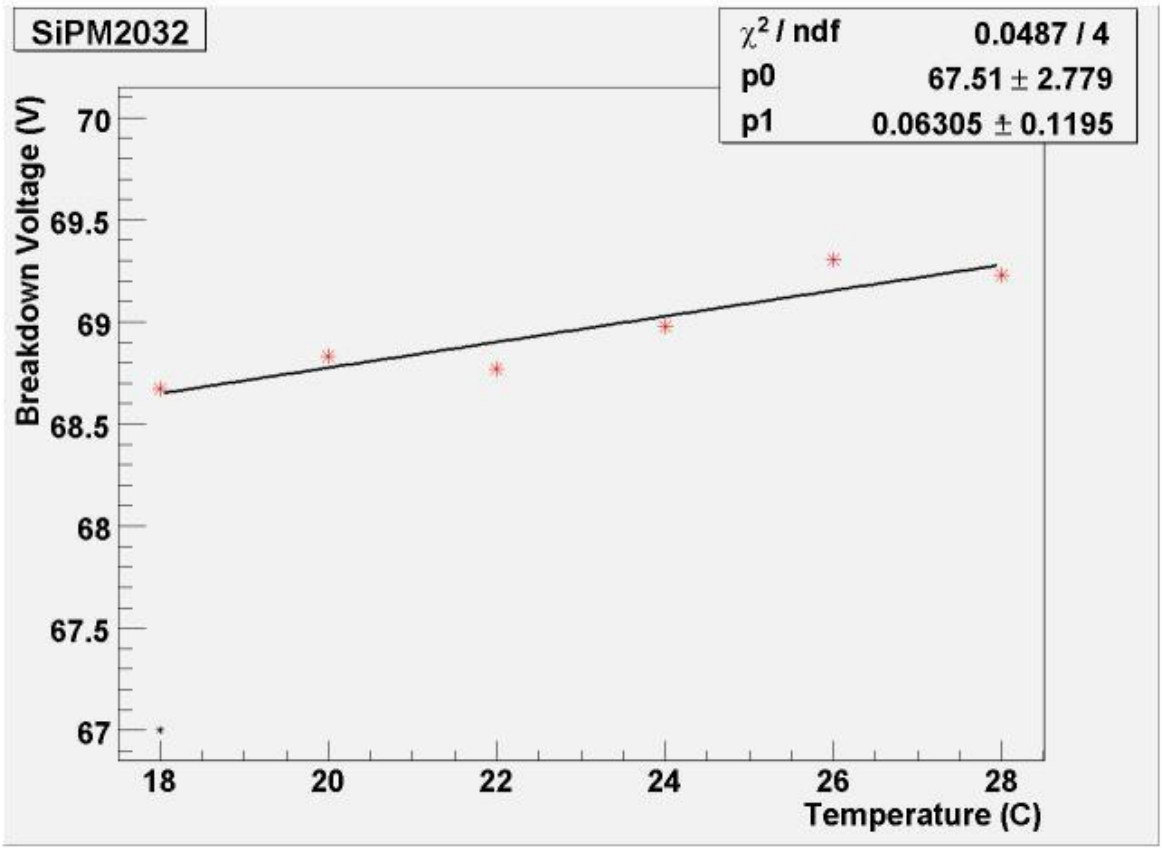
should be last week of Jan. – means all readout board should be in hand at least by Jan.15 to allow time for calibration of every single board, potting with silicon etc.

Plan is to parallel efforts with already secured additional manpower:

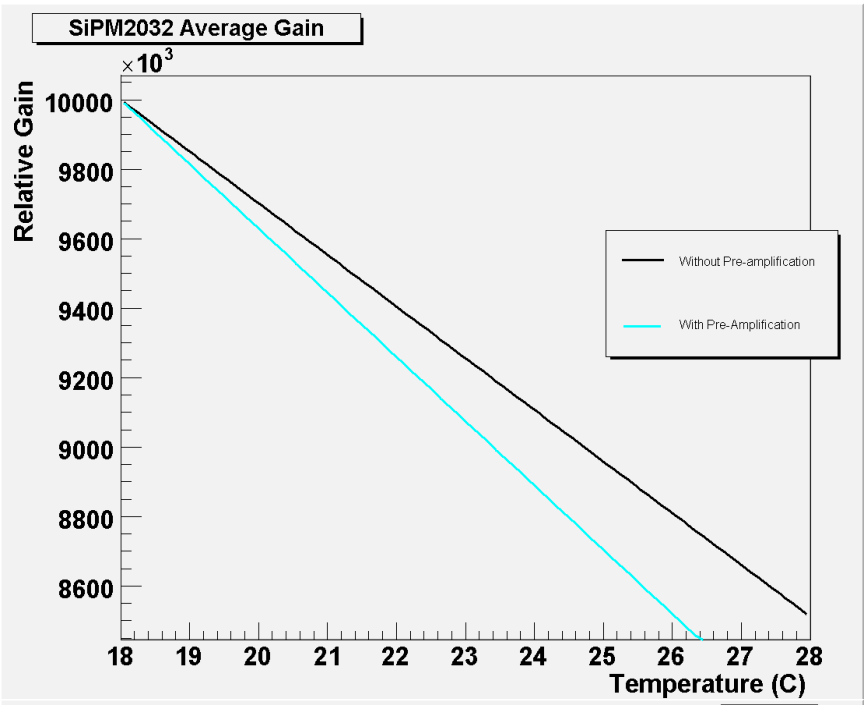
1. **STAR STSG is willing to produce/tests receiver and auxiliary (communication/power boards).**
2. **From Dec. will subcontract good technician at UCLA to work on FEE for two months, may be more.**

To make it work all technical questions and design of these boards at IUCF had to move fast.

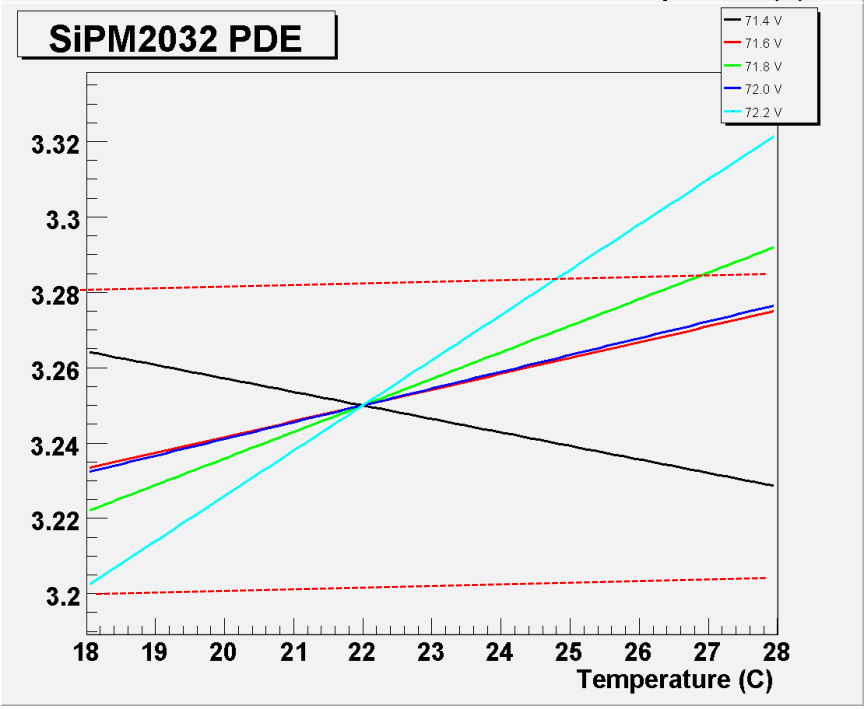
- T dependence of HPK sensors (work in progress, sorry for bad graphs – undregrads!)



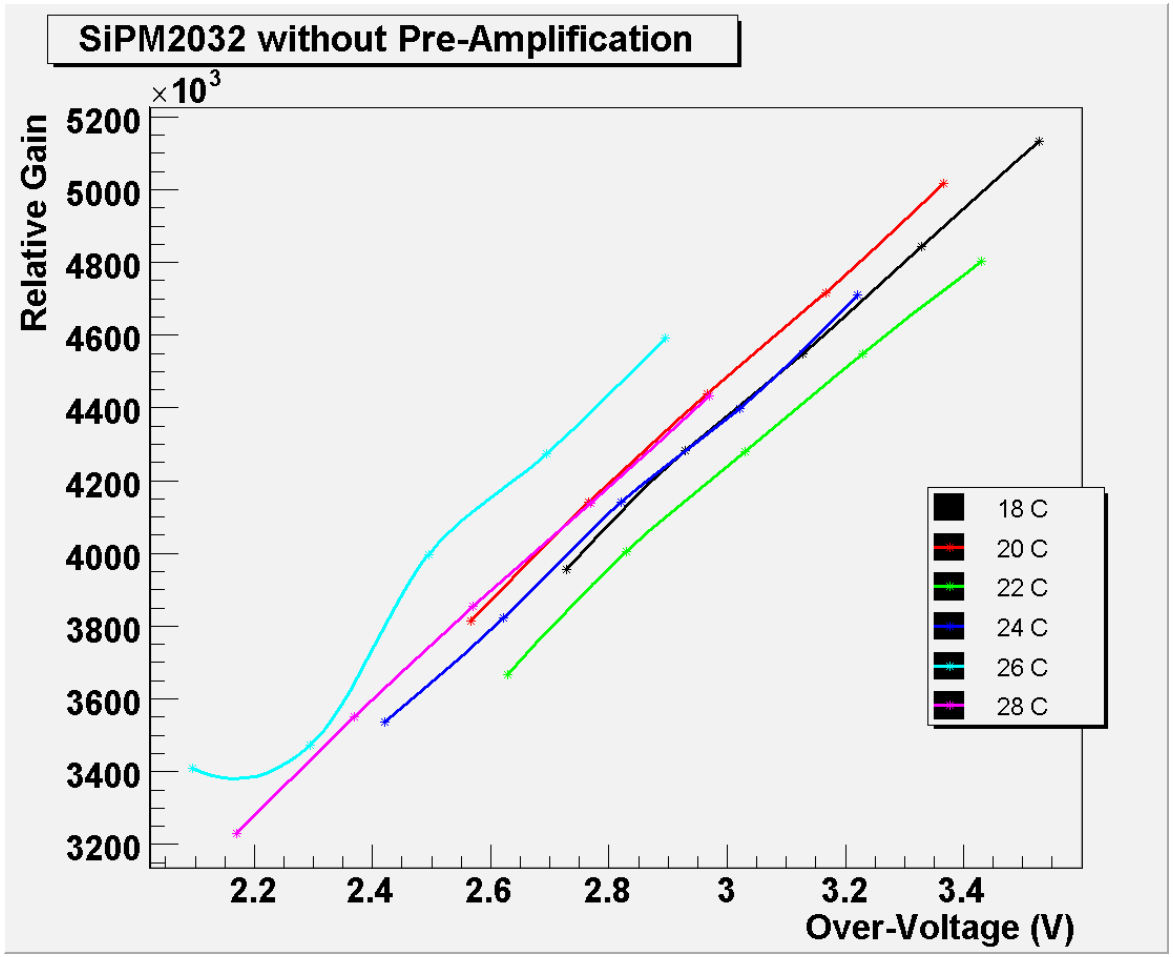
Essentially on FEE we need to compensate shift in breakdown voltage with T



At fixed bias voltage gain (response) drops with T about 1.5% per degree.



PDE seems to be changing little (red band is +- 1%)



Hoped to see same gain with over-voltage (above breakdown) – but it is not.

All results shown in last three slides very preliminary – need to continue on this, however with schedule undergrads have it is quite difficult.

- Let’s continue with discussion what we want to do next year.